Prosiding Simposium Pengurusan Teknologi, Operasi & Logistik, (SIPTIK IV)
14-16 Mei 2013, Universiti Utara Malaysia

THE SHORTAGE OF HELIUM SUPPLY IN INDUSTRY

Lim Yee Cheng and Risyawati Mohd Ismail

School of Technology Management & Logistic
Universiti Utara Malaysia
s207228@student.uum.edu.my ; risyawati@uum.edu.my

ABSTRACT

Shortage of Helium supply has been occurring globally. Helium is widely used in various sectors which include defense related, technology and science related. The shortage of helium has affected many industries, especially the healthcare industry. Helium is crucial the healthcare industry and are mainly used to reach cryogenic temperatures of -451 degrees for superconducting magnets in MRI, enabling the capturing of high resolution images of human tissue and organs. This review aim to discuss the nature of helium shortage, factors influencing the shortages, the importance and implication of helium shortage and the alternative method that could be considered to address these problems.

Keywords: Helium supply, healthcare industry, medical

1.0 INTRODUCTION

In 2012, the shortage of helium (HE) supply happens around the world such as Unites States, Europe and Asia. These shortages are caused by the rising demand for helium due to its widely application by many industries, including welding, defense, and healthcare.
Also, helium shortage supply could affect industry that requires helium. In fact, the application of helium is about 20% of the world's usage.

The major application of helium is in MRI machine in healthcare industry throughout the world. This shortage has resulted in MRI machines going out of order without upkeep. Without insufficient helium supply, MRI machine would cease to exist. The shortage could raise the price for helium. In fact, only 25% helium is used by medical sector. Some experts estimate the helium will be exhausted within 30 years.

The ppurpose of study is to study the current shortage helium in healthcare industry, and make several recommendations to reduce the problem.

2.0 LITERATURE REVIEW

The literature review will discuss about the application of the helium in MRI from all aspects.

2.1 Definition

Helium is the second abundant and second lightest element in all elements. It is a nontoxic, nonflammable, odorless, tasteless, colorless, and inert. Helium has eight known isotopes, but only helium-3 and helium-4 are very stable isotopes of helium.Helium-3 is comprised of 2 protons and 1 neutron.Helium-4 is comprised of 2 protons and 2 neutrons. The following contain feature of Helium:

- Helium boiling point is lower
- Helium is seven times lighter than air
- Helium has an low index of refraction .
- Helium has a high ionization potential.
- The thermal conductivity of helium is five times higher than the thermal conductivity of air.
- Helium has a low viscosity.
- Helium conducts sound three times faster than air.
- Helium melting point is lower
- Helium does not become radioactive under irradiation.
- When temperature close to absolute zero,helium becomes a superfluid ,but

for other elements it do not become superfluid.

2.2 Why helium shortage?

2.2.1 Maintenance problem at plants in Qatar, Algeria, and Australia

When the price for natural gas is cheap, caused increased in demand, and producers of gas will slow down the helium production. Some locations in the world that faced problem in refine helium because of maintenance problem.

2.2.2 A plant in Wyoming that has been delayed

A fire was happen in Wyoming and it could affect production of the Exxon Mobil operation Advertisement. The plant need about a year to solve. As a result, the plant extended the reopening and expected to open in the coming year.

2.2.3 Low price of natural-gas has reduced helium production.

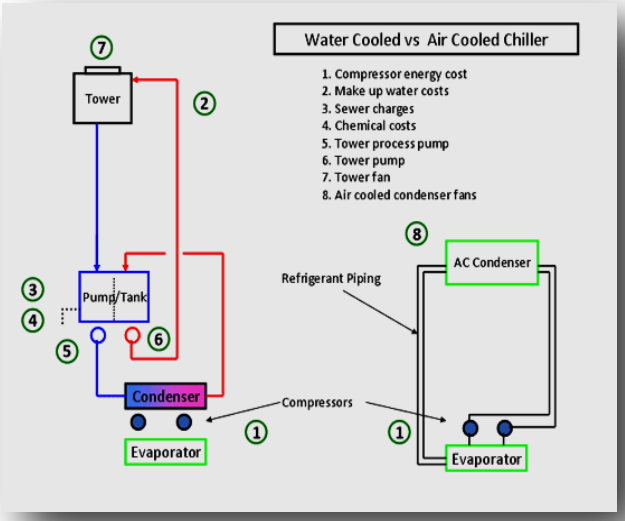
The world helium is extracted from natural gas. Helium plants are operating at a low concentration levels than U.S. plants, because they need to process higher volumes to make the processing worthwhile. A drop of natural gas price, make the process not profitable to the foreign plants.

2.3 The helium cooling system.

Liquid helium is used as a refrigerant. A chiller process is required for maintain liquid helium cooling system. In order to reach highest levels of efficiency at operation, the magnet inside the scanner should always keep cool.

There are two cooling methods are used that is air and water cooled chillers. Water-cooled chillers are intended for indoor installation and operation, and cooled by a separate condenser water loop and connected to outdoor cooling towers to expel heat to the atmosphere. Air cooled chillers are intended for outdoor installation and operation, and cooled by ambient air being mechanically circulated directly through the machine's condenser coil to expel heat to the atmosphere.

MRI scanner use the chiller for removing heat; Air and water cooled chiller are differ in heat transfer, either the surrounding ambient air or a water source such as a cooling tower.



2.4 Key Parameter

During the chiller system, there are several environment factors that may affect the chiller application. The key parameter to consider including the following:

Operating temperature: MRI machine is operate at the temperature of 452 below zero Fahrenheit.

Pressure: MRI machine keep in low pressure.

Water quality: chiller system use Dionized water to keep the water free from mineral build up.

2.5 The chiller process

The chiller process is used in MRI system in the healthcare industry. The healthcare need it to cool the MRI machine for operate properly. The following is the chiller refrigeration cycle:

- Compressor decreases pressure in evaporator to allow refrigerant to boil and absorb heat from water,
- Compressor increase pressure of refrigerant gas and discharges into condenser.
- Cooling water in condenser removes heat from refrigerant gas and enables it to condense into liquid.
- Metering device maintains seal between evaporator and condenser.

3.0 Methodology

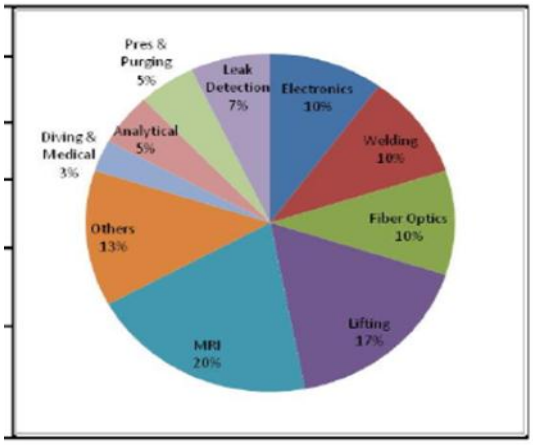
This chapter discusses the methodology methods that use the availability data in this research. In this study, this research conduct study on the application of helium. The analysis is done by article and resources from the internet.

4.0 DISCUSSION

Helium is very important it is because helium is quite rare on earth, and cannot be renewable. Also, helium is resources that cannot easy replacing by other resources. In addition, helium is natural resources, and it takes many years to process to become helium.

Shortage of helium supply can bring big impact to healthcare. It is because helium is used in MRI machines, and operates the machines to cool them down for imaging. Healthcare MRI machines needs the sufficient helium supply to refill for operate properly. Insufficient of helium supply could slow down the production of MRI machine. This slowdown of production of MRI cause the patient goes to other healthcare. In fact, this situation has cause sales of MR systems decreased 10% over the past year.

In addition, healthcare operation cost could increase due to increased costs for helium between 15% and 30% .When the demand for helium increased, then the prices will also increase.



This chart shows the shortage helium use in 2012 around the world. From this chart, it is clear that the major application of helium is by healthcare industry (20%) for cooled the MRI machine. Another application of helium is lifting (17%), others (13%), fiber optics, electronic and welding welding (10%), and leak detection (7%).

	Supply				
	Production	Inventory [1]	Total	Demand	Export (Import)
U.S.	3.0	2.1	5.0	2.3	2.7
Cnd/Mx & LatAm	0.0		0.0	0.5	(0.5)
Europe	0.1		0.1	1.4	(1.2)
Mideast/Afr/India	1.0		1.0	0.3	0.7
Asia	0.1		0.1	1.8	(1.7)
	4.2	2.1	6.3	6.3	0.0

This table shows the situation demand and supply of helium in several regions such as Unites states, Europe, India, and Asia. The high supply helium of Unites states is 5.0 with production (3.0) and inventory (2.1).The inventory of Unites States (2.7%) will export. For Asia, the lower helium supply is (0.1%) with production (0.1%) and inventory (0%).The Asia will import 1.7% helium to meet the demand.

5.0 LIMITATION

There are several problems that face when doing this study.

5.1 Times

For conduct a good research, period of time is the major important things. We do not have enough time to conduct this research because the time is spent on doing group assignment, and others. Also, we spent time in study for midterm exam.

5.2 Others

This research required some financial fees. The financial fees is pay by student participate in the process in conduct the research.

6.0 RECOMMENDATION

There are several recommendation for reduce shortage helium in the future.

6.1 Rational usage of helium

When the demand for helium is increase, rationing sources and place the price in the market value can provided motivation for innovative.

6.2Replacing alternatives sources for helium

To avoid the shortage in the future, find other sources to replacing helium such as hydrogen.

7.0 CONCLUSION

The world faced a shortage of helium due to increased demand by many industries .The helium shortage supply because the industry stops the production. To overcome this shortage, several recommendations are taken such as replacing alternatives sources for helium, and rationing usage of helium.

REFERENCES

FrancesRyland-Monk,AuntMinnia(2012). http://www.auntminnieeurope.com/index.aspx?sec=sup&sub=mri&pag=dis&ItemID=607180&wf=1?keepthis=true

PROPERTIES | HELIUM SCARCITY www.heliumscarcity.com/properties

Process Chiller for cooling applicants www.1stchoicechillers.com/processchillers.htm

MRI Chillers for Cooling Medical and Bio-logical Equipment http://www.temperaturecorporation.com/medicalchillers.htm

Paul Bruno.Helium Shortage 2012 http://maritime.about.com/%E2%80%A6ding/a/Helium-Shortage-2012.htm

(2013)Helium shortage 2.0-when will it end? http://www.gasworld.com/specialty-gas-report/features/helium-shortage-20-when-will-it-end/2001590.article

R. SUJATHA. (2012)Helium crunch hits MRI scans-The Hindu http://www.thehindu.com/news/cities/chennai/helium-crunch-hits-mri-scans/article4023518.ece

David Palmer.(2012)Deflating profits_ Helium shortage a problem for local businesses http://www.cullmantimes.com/local/x1744864295/Deflating-profits-Helium-shortage-a-problem-for-local-businesses